We thank the reviewer for taking the time to read our paper and for making a number of useful suggestions to improve the manuscript. This review has helped to reduce ambiguity in the manuscript and improve the presentation of our work. We have taken all of the comments on board and have submitted our responses below (red text) to each reviewer comment (black text).

"Characterising Methane Gas and Environmental Response of the Figaro Taguchi Gas Sensor (TGS) 2611-E00" introduces two field and laboratory logging systems (System A, System B), which were used for an extended deployment at a landfill site with Picarro reference and in an environmental chamber setup, respectively. Resistance of the Figaro sensor in relation to methane, temperature, and water vapor were modeled. Both phases resulted in unexplained variability (ambient air vs synthetic air under lab conditions; and ambient air resistance model in field conditions). A thorough discussion of the issues, including literature discussion, is presented. I think the work is sound and have only minor comments:

We appreciate that the reviewer recognises the value of our work. We hope to have improved the manuscript further by following their suggestions.

L88 Is 'trialed' meant here instead of 'trailed'?

We thank the reviewer for spotting this error which we have now rectified, as suggested.

The references to needing to operate in 'wet air' (L111) and elsewhere should be clarified. The Riddick et al. 2020 paper specifically talks about high uncertainty below 40% relative humidity. Additionally [H2O] is defined as the 'water mole fraction' on L19 but that this is usually specified as water vapor mole fraction since solid and liquid phases are also possible.

We agree that greater clarity is required here. Having reviewed the cited literature again, we have improved the details provided on the effect of water vapour on sensor behaviour. Rivera Martinez *et al*. (2021) showed that resistance was abnormally high at 0% [$H_2O$] compared to 1% [$H_2O$]. Eugster and Kling (2012) showed that TGS resistance was unpredictable below 35% relative humidty. Riddick *et al*. (2020) remarked that based on the Eugster and Kling (2012) study, calibrations must be performed in wet conditions. Following our changes, we hope that these points are now more accurately incorporated in the manuscript in section 1.

We have also now changed "water mole fraction" to "water vapour mole fraction" to avoid confusion and to make it clear that we are referring to water in the vapour phase.

Fig 4: Is the Raspberry Pi 3B+ computer outside of the cell pictured? This is important for understanding the data logging configuration

This is a good point. We now clarify in the caption for Figure 4 that the photograph only depicts the logging cell and not the entire logging system, with the logging computer and power supply not shown. The figure has been updated with an arrow pointing towards the cable which both supplies power and provides connections to the analogue-to-digital converter. We also now explicitly clarify the external placement of the logging computer in section 3.3.

L200 Is Picarro serial feed sent to the Raspberry Pi? It is minor, but simultaneous logging on a computer does not automatically solve timing issues because the Picarro and ADC board used for the Figaro still have separate clocks.

The Picarro streams data to System B using a serial data connection. This detail has now been added to the manuscript. When the Picarro data reaches the System B logger, it is written directly into the System B data file. Therefore, only the System B timestamp is used. There is no use for the Picarro timestamp, which is not recorded by System B, so it does not matter if the Picarro has a separate clock. We apologise for any confusion here and have made efforts to make this point clearer in section 2.3.

As the Picarro data is simply written into the datafile alongside the Figaro data, it does not matter whether the time is accurate or not. So long as a single time stamp is being used, the laboratory experiment is not affected. We acknowledge that this does not solve timing accuracy issues (*i.e.* if System B time in not precisely equal to UTC). However, it eliminates any issues with a time offset (*i.e.* if the Picarro time is different to the System B time), which may become an issue if attempting to combine two separate data files.

L233 suggest moving the statement “All synthetic air cylinders contain a natural balance of nitrogen, oxygen and argon.” to the paragraph starting L254 once it is mentioned that multiple synthetic air cylinders were used

This is a good idea. We have followed the reviewer’s suggestion.

L239 Does stabilization of [H2O] in the ‘large environmental chamber’ also play a role, or the settling can simply be attributed to the Figaro?

As this test was conducted with System B in the laboratory and not in the environmental chamber, we can be certain that the observed effect was due to the Figaro itself. We apologise for any confusion here and added a sentence in section 3.2 describing how System B testing was performed in an air-conditioned laboratory. We have also added a sentence in section 2.3 to clarify that this test took place in System B, where [$H_2O$] was held constant, thanks to the dew-point generator. Only System A was tested in the environmental chamber.

L345 How was the dilution from 5% [CH4] in argon all the way down to 2 ppm achieved? The accuracy of the dilution seems somewhat important, since the agreement with the 2 ppm synthetic air and disagreement with ambient laboratory air is a key area of discussion in the manuscript

In this methane characterisation test, ambient air was used as a standard reference gas, which naturally contains about 2 ppm [$CH_4$]. Therefore, 2 ppm [$CH_4$] was quite simply achieved by sampling pure ambient air, with no dilution. In order to increase [$CH_4$] up to 1 000 ppm, we used mass-flow controllers to add small quantities of gas from a 5% [$CH_4$] cylinder. We now direct the reader to section 2.3 in section 3.4, where the mass-flow controllers are discussed. The Picarro G2401 reference instrument was used to deduce the resulting [$CH_4$] from the gas blend.

In section 3.2, where different 2 ppm [$CH_4$] sources were compared, a 2 ppm [$CH_4$] sample was achieved by diluting 5% [$CH_4$] gas with zero-air generator gas, which contains 0 ppm [$CH_4$]. This was also achieved using mass-flow controllers. As all Figaro laboratory testing was conducted alongside a Picarro G2401 reference instrument, we can be sure that the mass-flow controllers successfully produced a 2 ppm gas blend during this test. Thus, we were always aware of the [$CH_4$] level in the gas stream, regardless of uncertainty in the mass-flow controller flow rate.

L522 'model yielded excellent R2 agreement during chamber testing (see Fig. 8)' This is not shown in Figure 8

The reviewer is right to highlighted that Figure 8 is a visual representation of the background resistance model and does not allow the reader to evaluate model agreement. We instead direct the reader to Table 2 here, where $R^2$ and RMSE values are given.

L568 I think the statement 'chamber testing may not be suited for SMO sensors in general.' is stronger than what is said in Eugster et al. 2020. Moreso that lab calibration can, and ideally should, be incorporated, but field calibration is simpler to do accurately

This is a good point. We have rewritten this sentence more factually, without drawing general conclusions from the work of Eugster *et al.* (2020). We simply state that Eugster *et al.* (2020) yielded unsatisfactory results from chamber testing, as stated in their section 3.5.

The figure font sizes / arrangement could use some work, as Figures 1, 7, and others are relatively hard to read even while spanning a full page in this version

We have updated most of the figures in the manuscript, with improvements including higher resolution and fewer white spaces. Regarding Figure 1, we have changed the background colour to white, making the text easier to read, which we have also emboldened. We have made a number of improvements to Figure 7 including increasing the size of the axis labels and titles. We have also plotted all environmental chamber resistance measurements as coloured dots, instead of black dots, to make them easier to distinguish. The periods used to derive 30-minute averages are now shown as black bars at the top of the plot. In the previous version of this plot, individual SHT85 temperature and water mole fraction measurements from each System A logger were plotted as overlapping dots. We have now changed this by presenting average temperature and water mole fraction values from all five System A boxes, as they are almost identical. The average standard deviation in temperature was 0.14° C and the average standard deviation in [$H_2O$] was 0.01%, between the different System A boxes.

On Fig 18, the number of data points is high so using a stripplot for the individual data does not add much information versus just showing a standard boxplot. A swarmplot may be preferable for showing the individual points

The reviewer makes a good suggestion. We attempted to produce a swarm plot here, but there were too many densely packed measurements in the centre of each data range, making it impossible to present this figure nicely. However, we fully agree with the reviewer's suggestion that a box plot is otherwise more apt here. We have therefore updated this figure as a simple box plot.